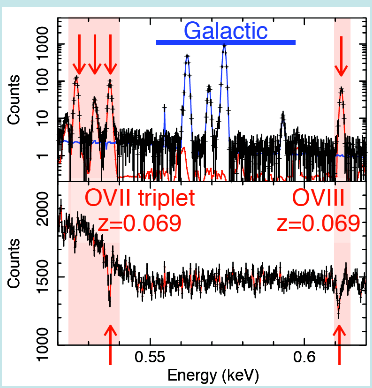
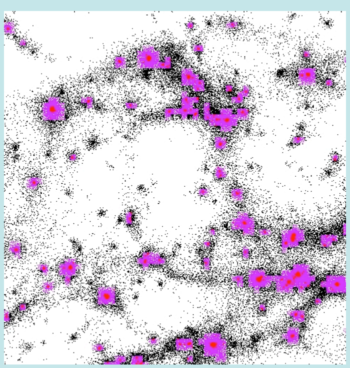
XENIA: Cryogenic Imaging Spectrometer

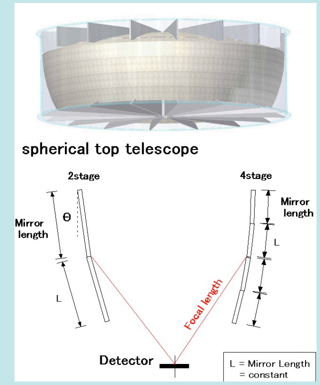
The *Cryogenic Imaging Spectrometer (CRIS)* will enable imaging of an area of 0.9 x 0.9 degree^2 with a few eV resolution. In order to have sufficient sensitivity a new mirror concept is adopted. A short focal length gives a large Field of View for the very small detector. Using two-fold and four-fold2reflections the effective area is typically about 1000 cm^2 over the energy range (0.3 – 2.2 keV). For the detector an array of microcalorimeters, read out by Transition Edge Sensors (TES), has been selected. These TES are operated at the transition between superconductivity and normal conductivity (around 100 mK). Following a hit of the calorimeter by a photon, its temperature will raise with a corresponding change in resistance.



With a spectral resolution of a few eV it is possible to identify emission and absorption lines due to the WHIM. Using the red-shift of these lines, emission lines from the WHIM (at a given red-shift) can be separated from the strong Galactic foreground. If regions of the sky are selected where also GRBs are detected and observed by Xenia, the same WHIM filament will also be observed in absorption, allowing for unique constraints on temperatures and densities.

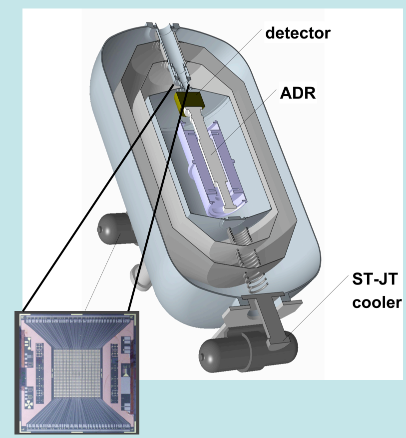


Using the imaging capability of the instrument the morphology of the WHIM can be made for a 5 x 5 degree^2 area.



Schematic drawing of the X-ray mirrors indicating the combination of 2-fold (inner mirrors) and 4-fold (outer mirrors) reflections

Typical layout of a micro-machined detector array (1.9 x 1.9 cm^2). A cryogen free cooling system will be used where the 50 mK temperature is achieved by a combination of 2 stage Sterling coolers, a Joule Thomson cooler and an Adiabatic Demagnetization Refrigerator.



The X-ray mirrors are being developed in Japan (Nagoya University). The detector is similar to the detector for the International X-ray Observatory (IXO) and is developed by a consortium in the US (NASA/GSFC), Japan (ISAS), Italy (INAF-IASF) and the Netherlands (SRON).